



# **OPTICAL NETWORK TESTBEDS WORKSHOP 3 (ONT3) Overview**

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# ONT3

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- Sponsorship
- Overview
- Goals
- Structure
- Research Directions
- Future Research Plans



# Sponsorship

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- Co-Sponsored by the US and Japan
- US: Department of Energy (DOE), National Science Foundation (NSF).
- Japan: National Institute of Information and Communications Technology (NICT)
- Co-Chair Was Tomonori Aoyama, Keio University and NICT
- Organized in cooperation with the Federal Large Scale Networking Coordination Group (LSN).
- NASA Ames Research Center Is Hosting the Web Site



# Optical Services And Technologies

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- ONT Workshops Focus on Areas Not Addressed At Other Forums.
- The Basic Focus of ONT Workshops Is On Optical Communications Services And Technologies L1, Lightpath Based (Wavelength-Based) Services – Combining Research Topics With Discussions of Early Implementations.
- By Design - Not L3 or Other Networking Technologies, e.g., Wireless, Satellite, etc
- Optical Technology Has Been Widely Recognized As A Key Enabler Of a Wide Range of New Capabilities
- New R&D Continues to Make Advances By Discovery of New Methods
- This Area of Research Investigation Is A Key Initiative Related to Fundamental Reconceptualization of Basic Network Theory, Design, and Implementation



# Observations

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- When Research Into These Topics Was Initiated Around 2000, It Was Highly Controversial
- This Research Generated A Series of Major Debates and Opposition from Many Directions
- Today, These Concepts Have Been Almost Universally Accepted, Among the Research Community, the Advanced Networking Communities, and Industry



# Optical Services and Technology Topics

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- Topics (Structure) Within a Range of Time Horizon Perspectives
  - Future Research Plans (5-15 Year Horizon)
  - Basic Research and Experimentation (3-5 Year Horizon)
  - Early Prototypes (2-3 Year Horizon)
  - Early Pre-Production Implementations (1-2 Year Horizon)
  - Production Implementations (Current)
- International Issues
  - Services
  - Facilities
  - Exchange Points
  - Technologies



# Workshop Organizational Background

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- Workshop Was Organized To Build On Prior Workshops: the September 2005 Workshop on Optical Network Testbeds (ONT-2) and the 2004 ONT-1
- ONT-1 Provided An Overview of Directions in Optical Communications and Recommendations
- Ref:<http://www.nren.nasa.gov/workshop7>
- **ONT-2 Was Designed As a Forum That Could Assist In Creating the Means to Transition the Community and Its Networking Infrastructure to Leading Edge, Next Generation Optical Networks.**
- ONT-2 Developed Specific Frameworks for Community Actions In the Context of 5 Year Roadmaps
- ONT-2 Presented These Roadmaps Within Categories of Development, From Basic Research Testbeds to Early Implementations to Initial Production
- Ref: <http://www.nren.nasa.gov/workshop8>



# ONT-3 Workshop Objectives

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- ONT-3 Was Designed
  - To Continue the Efforts Initiated Through ONT-2
  - Emphasize the Theme of Next Generation International Optical Communications
  - Indicate the Contribution of These Concepts To the Wider Networking Context, e.g., Next Generation Designs and Experimental Testbeds
  - Drivers: New Applications, New Services, New Disruptive Optical Technologies
  - GENI/NICT New Generation Network/Distributed Facility Concepts





# ONT-3 Workshop Objectives

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- The Forum Presented – In an **International Context**
  - Progress Has Been Made This Year In Moving Toward
    - Long and Near Term Objectives
    - In Achieving Roadmap Milestones
  - Progress Made This Year In Establishing Mechanism for Continuing to Achieve Key Goals and Continuing to Ensure Momentum
  - Much Has Been Accomplished in This Area Over the Last Year, Demonstrations, Prototype Services, Early Implementations, New Testbeds
  - Multiple Publications Have Appeared
  - Many New Related Activities Have Been Established in Communications Standards Organizations



# A New Architecture

- The Traditional Network Is Being Replaced
- A New Architecture Will Provide For New Communication Services Based on a New Foundation
- A Major Challenge To Advancement Is the Installed Base, Which Is A Barrier To Innovation
- For example, the Current Traditional Internet Constitutes a Barrier To Its Improvement
- The New Environment Must Provide Capabilities for Both On-Going Production and New Innovation
- The New Architecture Provides For Not a “Network” Design But Instead For A Large Scale Highly Distributed Facility That Can Change Instantaneously In Response To Changing Requirements
- Also, Distribution Not Only of Resources But Also Control and Management Functions

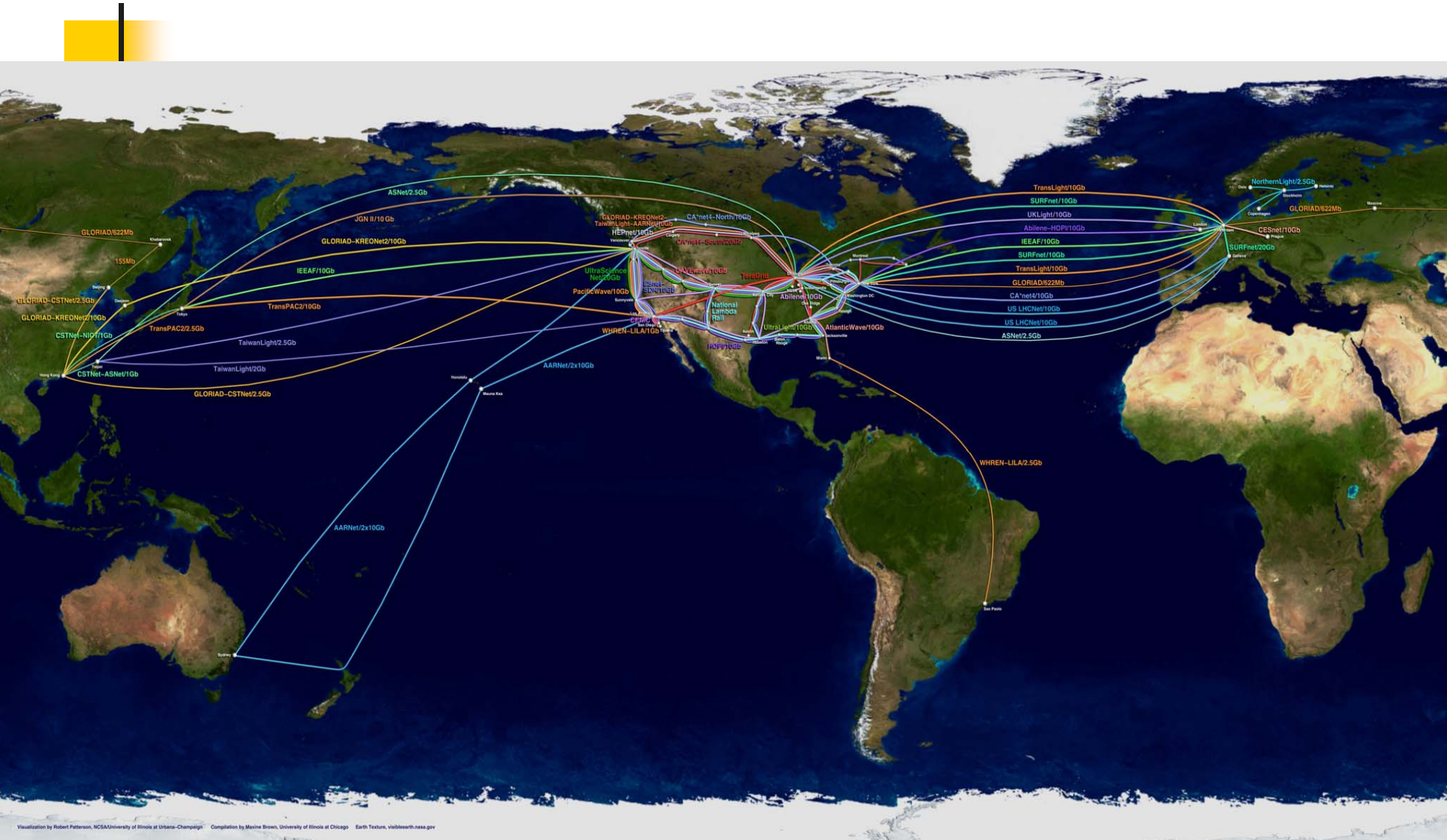


# Implications for Optical Networks

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- Facilities Exist Today Which Reflect These Principles
- Multi-Layer/Multi-Service Communications Infrastructure
- These Facilities Reflect the Future of Communication Services
- A Highly Distributed Facility (“Lambda Grid”) Is Being Designed To Support Multiple Networks With Different Characteristics Each Supporting Multiple Highly Differentiated Services
- The Core of This Facility Will Be Based On Next Generation Agile “Intelligent” Optical and Photonic Technologies
- These Innovations Are Being Driven By Advanced Optical/Photonic Research Networking Organizations In Response To Application Demand and By New Innovations In Optics and Photonics
- The Future is Light!

# Global Lambda Integrated Facility (GLIF)



Visualization by Robert Patterson, NCSA/University of Illinois at Urbana-Champaign; Compilation by Maxine Brown, University of Illinois at Chicago; Earth Texture, visibleearth.nasa.gov



# For Further Information, Ref:

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- The ONT3 Report Will Be Published on the Workshop Web Site In Approximately 3 Months
- The ONT3 Presentations Are on the Site
- [www.nren.nasa.gov/workshop9](http://www.nren.nasa.gov/workshop9)
- (ONT3)
- [www.nren.nasa.gov/workshop8](http://www.nren.nasa.gov/workshop8)
- (ONT2)
- [www.nren.nasa.gov/workshop7](http://www.nren.nasa.gov/workshop7)
- (ONT1)



# ONT3 Thanks

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- Sponsors

- Makoto Nagao, NICT
- Guru Parulkar, NSF
- George Seweryniak, DOE
- Grant Miller, LSN, NITRD



# ONT3 Thanks

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- Organizers
  - Makoto Nagao, NICT
  - Kunihiro Kato, NICT
  - Tomonori Aoyama, NICT/Keio University
  - Akira Amemiya, NICT
  - Asako Toyoda, NICT
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  - Koichi Hiragami, NICT
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  - Yusuke Komatsuzaki, NICT
- Logistic Coordinators
  - Scott Macdonald, e-Side
  - Sally Miller, NASA
- All Participants!